

course, not all topics are treated with the same amount of detail but enough is given to introduce the subjects and to enable the reader to use it in simple applications.

One of the outstanding attractions of the book is its emphasis on practical applications. This is shown by the author's devoting an entire chapter to the distribution of the range, a topic which lacks mathematical elegance but which is useful in practice. Throughout the book, it is emphasized that the standard statistical techniques are derived for the normal distribution only but that in many cases skew distributions are required. Consequently, the author is careful to indicate what techniques can be used for skew distributions and more important to show how a skew distribution can be transformed to the normal by suitable transformations.

There are some defects. In a few cases the author's notation is not standard and this may prove a source of confusion to the student. For example, the author uses $U \dot{+} V$ for the logical sum of the classes and $U + V$ for the sum with the common part omitted. The standard notation for the first concept is $U \cup V$ and it would have been just as easy for the author to use the dot to indicate the second concept. Again, in the analysis of variance, the author uses u and v^2 instead of the well-known s and F . A more serious criticism is that, because of the arrangement of topics, some concepts are introduced before they are explained. For example, on page 36 an example involving tolerance limits is discussed while the concept is not formally introduced until page 311. Also, the "Studentized" range is mentioned before Student's distribution is treated. However, these examples of foreknowledge are few. On the whole, the reviewer feels that the book can be highly recommended.

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Physics and Medicine of the Upper Atmosphere. A Study of the Aeropause. Edited by Clayton S. White and Otis O. Benson, Jr. 611 pp. The University of New Mexico Press, Albuquerque, New Mexico, 1952. \$10.00.

The fact that able scientists, including a Nobel laureate, would devote an appreciable amount of time to the problems of space travel and to the physics and medicine of the upper atmosphere is a striking indication of the rate at which the field of aviation and aviation medicine is progressing. This volume is the outgrowth of a symposium on the physics and medicine of the upper atmosphere held somewhat over a year ago.

While only a small amount of new factual data have been obtained, the bulk of the material in this volume can be regarded as authoritative. In any consideration of travel in the upper atmosphere, theory and conjecture hold primary sway. Nonetheless, as our knowledge of the ionosphere is widened by the use of rockets and guided missiles, a certain amount of reality can be interspersed. Problems are manifold, and how living organisms, including man, will behave under the conditions of pressure, temperature and variations of gravi-

tational field that will occur is still in large part to be determined.

The medical department of the U. S. Air Force is to be congratulated in taking an active part in these extraordinary pioneering studies which may lead eventually to readjustment of man's relation to the universe.

This volume represents the thinking of adventurous-minded pioneers who have at the same time the moderating effect of their scientific knowledge.

Inevitably in a symposium a certain amount of duplication of material occurs and the various chapters in this volume are no exception. However, this is not as serious a handicap as it would be, were the concepts under consideration not so novel. While the volume unavoidably has a certain flair of Jules Verne and the comic strip, nonetheless the documentation is sound and the speculation restrained. Few interested in problems of flight and in the wider-flung frontiers of human knowledge can afford to neglect it.

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Electrodynamics. Lectures on Theoretical Physics. Volume III. By Arnold Sommerfeld. 371 pp. Academic Press Inc., New York, 1952. \$6.80.

"I can best give you an idea of the sweeping changes in viewpoint brought about by the theory of Faraday and Maxwell by telling you of the time I spent as a student . . ."—so begins Part I (54 pp.) of the four parts that make up the text. After a brief historical review and discussion of basic concepts, Maxwell's equations in integral form are presented as the axiomatic foundations of electromagnetics. Auxiliary concepts and postulates are then introduced and their principal consequences deduced. Part I ends with a discussion of units and the selection of the rationalized MKSQ system for the major part of the text.

In Part II (156 pp.), the fundamental equations are used to deduce the basic phenomena of the static, stationary, quasi-stationary, and rapidly varying fields. The section on statics treats charging and induction problems, the sphere in a uniform field, capacitors, the field of the permanent bar magnet, and the field within an ellipsoid of revolution; here there are departures from the phenomenological viewpoint to discuss polarization and magnetization on the molecular level. Next, stationary currents and their magnetic fields, mutual and self induction, and the magnetic double layer are discussed; the fields of a straight wire and coil are treated in detail. This leads into a brief discussion of quasi-stationary currents: the free and forced vibrations of a circuit, the Wheatstone bridge, coupled circuits, and the telegraph equation. Part II ends with the treatment of rapidly varying fields, the retarded potentials, the Hertzian dipole, and cylindrically symmetric fields. Detailed applications to the field of a circularly cylindrical wire and coil, to waves on wires, to wave guides, and to the Lecher two-wire line are given.

Part III (67 pp.) deals with special relativity and the

theory of the single electron. The four-vector potential and current density and the six-vector fields are introduced to exhibit the space-time symmetry of Maxwell's equations: their "natural" invariance to a transformation from one reference system to another moving with a linear uniform relative velocity constitutes the principal of relativity in its electrodynamic formulation. The group of the Lorentz transformations, relativistic kinematics, and the theory of the electron are treated in some detail.

Part IV (42 pp.) considers Minkowski's equations for moving media, approaches to the generalization of Maxwell's equations to elementary particle theory, and general relativity.

The book ends with twenty-five mature problems; the answers and comments which are included are integral parts of the text.

In the reviewer's judgment this text is the best available for a graduate physics course in electromagnetics. That so much could be dealt with rigorously in so small a volume is remarkable; it was achieved by stressing the physics rather than the mathematics involved and by carefully selecting the problems so as to minimize the use of special functions and function theory. The reader is provided with a carefully chosen vantage-point from which to view the broad panorama of electromagnetic theory. Although certain gaps have been left, these are preferable to the detailed investigations that would have been required to fill them and which might have served to distract from the physically interesting and essential.

The present book, although complete in itself, should of course be considered within the framework of the six-volume set of the late Dr. Sommerfeld's lectures on theoretical physics. Thus Volume IV, *Optics*, and Volume VI, *Partial Differential Equations*, provide excellent supplements in which certain of the more specialized or mathematically sophisticated topics are treated.

Sommerfeld's experiences as a student during the period when Heaviside and Hertz "purified" Maxwell's equations and first wrote them in their present form lend a marked personal flavor to the writing. The personal tone of many sections (e.g., those dealing with waves on wires, the Lecher wire system, the space-time symmetrical form of Maxwell's equations) is highlighted by the significant contributions to the subjects made by Sommerfeld and his students.

The only feature of the book we find sufficiently negative to comment on is its almost mystical and morbid preoccupation with units: more than fifteen pages (or about five percent of the text proper) is devoted to this topic. Most of us will agree that the dimensional character of the fields deserves consideration and that the rationalized MKS system is most convenient when working with Maxwell's equations. However, few will go along with the implication that there is more than convenience to the choice of units and that there exists an ultimate set whose discovery awaits a theory of the elementary particles.

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Books Received

ELEMENTS OF HEAT TREATMENT. By George M. Enos and William E. Fontaine. 286 pp. John Wiley and Sons, Inc., New York, 1953. Chapman & Hall, Ltd., London, England. \$5.00.

RELATIVITY AND REALITY. A RE-INTERPRETATION OF ANOMALIES APPEARING IN THE THEORIES OF RELATIVITY. By E. G. Barter. 131 pp. Philosophical Library, New York, 1953. \$4.75.

CRYSTAL STRUCTURES. Section III and Supplement II. By Ralph W. G. Wyckoff. 639 pp. Interscience Publishers, Inc., New York, 1953. \$18.50.

CIRCUIT THEORY OF ELECTRON DEVICES. By E. Milton Boone. 483 pp. John Wiley and Sons, Inc., New York, 1953. \$8.50.

KERNEL FUNCTIONS AND ELLIPTIC DIFFERENTIAL EQUATIONS IN MATHEMATICAL PHYSICS. By Stefan Bergman and M. Schiffer. 432 pp. Academic Press Inc., New York, 1953. \$8.00.

THE VITAL CORRELATIONS 3-DIMENSIONAL UNIFIED FIELD THEORY. By Morris J. Spivak. 23 pp. Vital Correlations Foundation for the Unification of Knowledge in 3 Dimensions, Ithaca, New York, 1953.

AN INTRODUCTION TO SYMBOLIC LOGIC (Second Revised Edition). By Susanne K. Langer. 368 pp. Dover Publications, Inc., New York, 1953. Clothbound \$3.50, paperbound \$1.60.

A HISTORY OF ASTRONOMY FROM THALES TO KEPLER (Second Revised Edition). By J. L. E. Dreyer. 430 pp. Dover Publications, Inc., New York, 1953. Clothbound \$3.95, paperbound \$1.95.

THE WORKS OF ARCHIMEDES, with a supplement THE METHOD OF ARCHIMEDES. Edited by T. L. Heath. 563 pp. Dover Publications, Inc., New York, 1953. Clothbound \$3.95, paperbound \$1.95.

COMMUNICATION THEORY. Papers Read at a Symposium on "Applications of Communication Theory", London, 1952. Edited by Willis Jackson. 532 pp. Academic Press Inc., New York, 1953. \$11.00.

STANDARD X-RAY DIFFRACTION POWDER PATTERNS. NBS Circular 539. Volume I. By Howard E. Swanson and Eleanor Tatge. 95 pp.; Volume II. By Howard E. Swanson and Ruth K. Fuyat. 65 pp. U. S. Government Printing Office, Washington 25, D. C., 1953. \$0.45 each.

PROBABILITY TABLES FOR THE ANALYSIS OF EXTREME-VALUE DATA. NBS Applied Mathematics Series 22. 32 pp. U. S. Government Printing Office, Washington 25, D. C., 1953. \$0.25.

ULTRA HIGH FREQUENCY PROPAGATION. By Henry R. Reed and Carl M. Russell, assisted by W. M. Browne and J. W. Plummer. 562 pp. John Wiley & Sons, Inc., New York, 1953. \$9.50.

SELECTED VALUES OF PHYSICAL AND THERMODYNAMIC PROPERTIES OF HYDROCARBONS AND RELATED COMPOUNDS. Comprising the tables of the American Petroleum Institute Research Project 44 extant as of December 31, 1952. By Frederick D. Rossini, Kenneth S. Pitzer, Raymond L. Arnett, Rita M. Braun, and George C. Pimentel. 1050 pp. Carnegie Press, Pittsburgh, Pennsylvania, 1953. \$7.00.

PASTEUR'S AND TYNDALL'S STUDY OF SPONTANEOUS GENERATION. Case 7 of the Harvard Case Histories in Experimental Science. Edited by James Bryant Conant. 61 pp. Harvard University Press, Cambridge, Massachusetts, 1953. \$1.25.